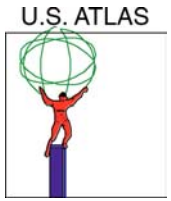
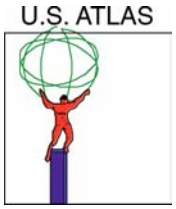


Details of the U.S. ATLAS Research Program

Howard Gordon

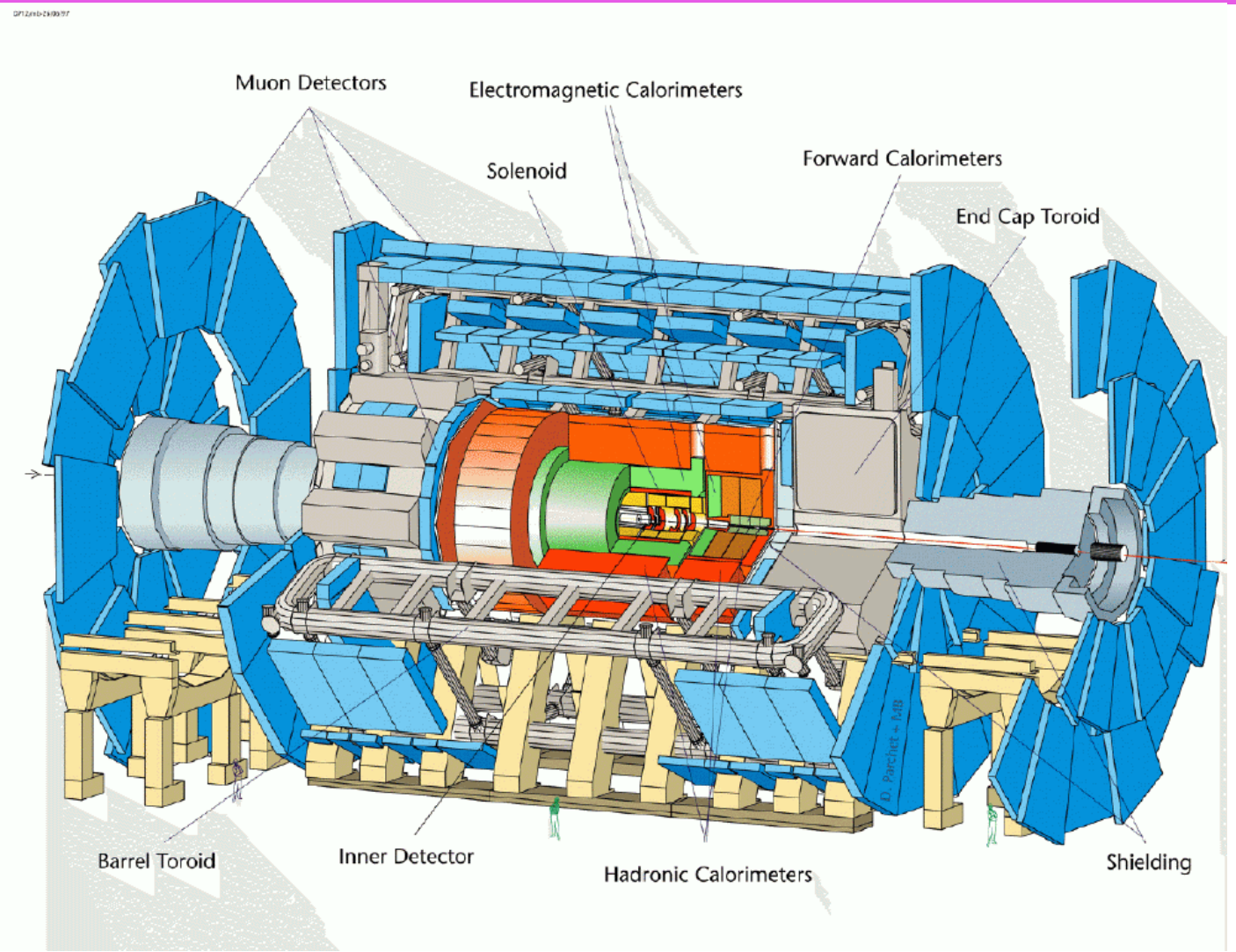


Introduction

- Generally we are planning for the transition from Construction → Completion → Successful Operation
- LHC Schedule: expect first collisions Spring 2007
  - At this time, we still plan to complete the Construction Project by Sept. 30, 2005
  - M&O starts in FY02
- Installation is part of the Project
  - Installation is strictly defined as the act of placing a U.S. ATLAS Deliverable into ATLAS – e.g. placing a muon chamber on the Big Wheel
- Upgrades are not part of the Research Program
- Review of our Definitions
- Methodology of our cost estimates

U.S. ATLAS

The ATLAS Experiment



ATLAS Cavern Progress

UX15

sequence of operations:

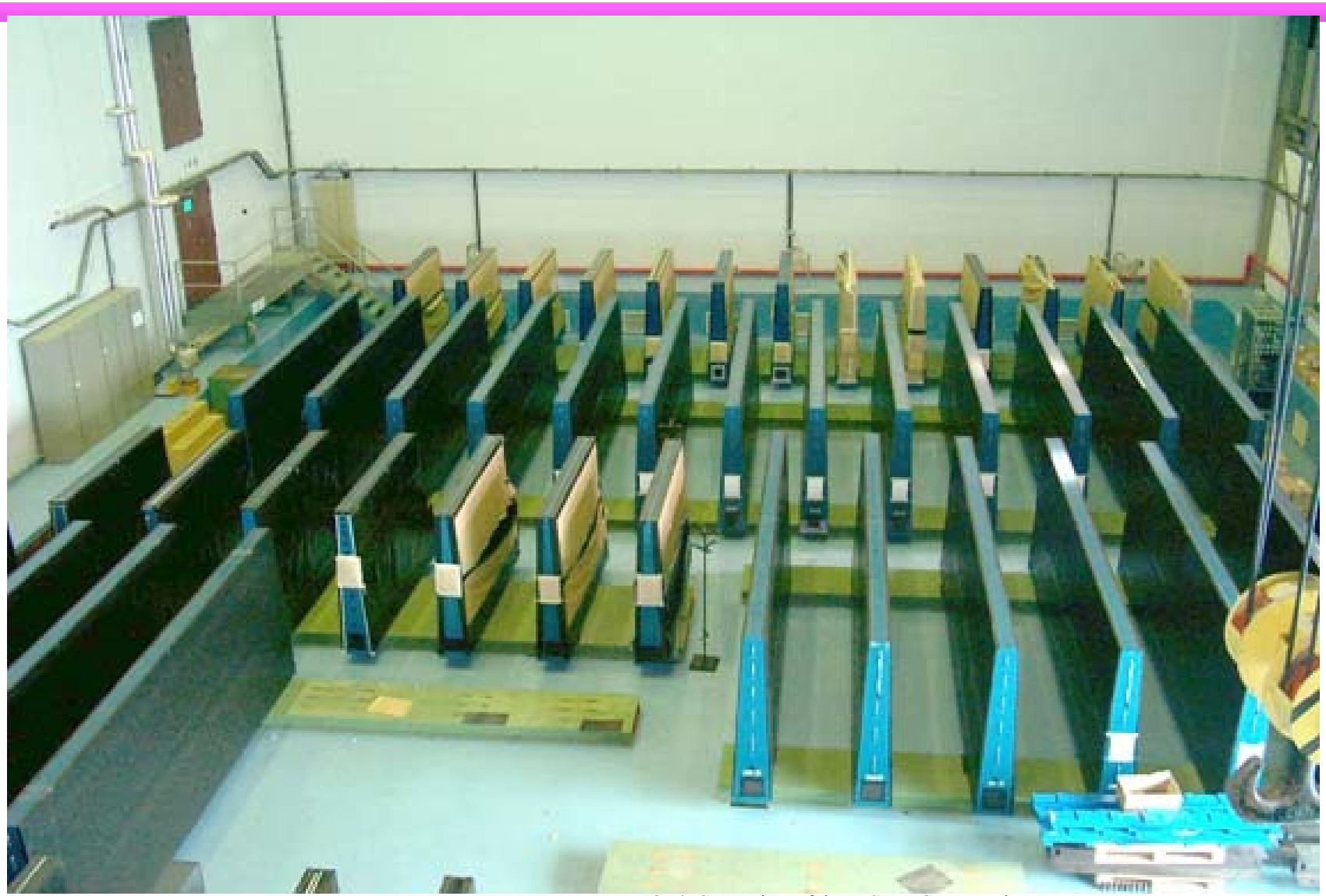
- LEP level reached in Nov. 2001
- excavation of UJ beam caverns
- February 2002 UX15 excavation restarted
- excavation should end by May 2002

2/28/2002

Barrel Toroid is Moving

U.S. ATLAS

U.S. Detector Components are at CERN

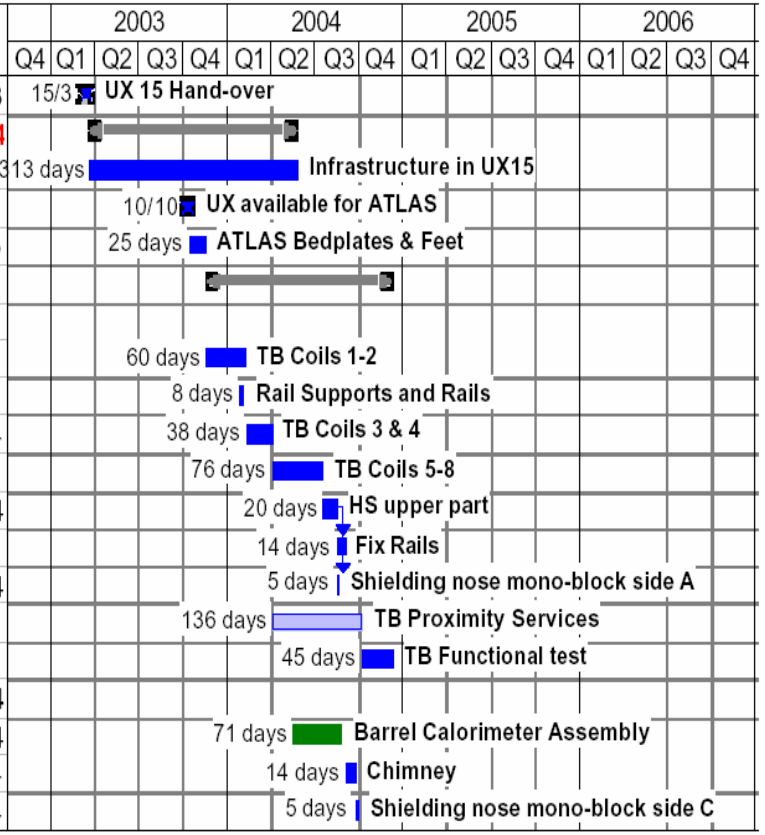


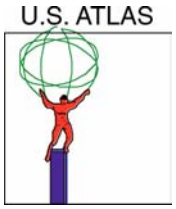
Version 4 of the ATLAS Installation Schedule

~2.5 months added to the installation of the barrel toroid as requested by the magnet ASSO internal review

Version 5.0 of the schedule will be released soon to reflect the 2007 start – summer 2002 – most items slip by only ~1-3 months

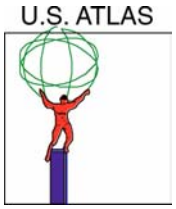
Criti	Task Name	Duration	Start	Finish
	UX 15 Hand-over	0 days	15 Mar '03	15 Mar '03
	PHASE 1: Infrastructure & Feet	**313 days**	**17 Mar '03**	**26 May '04**
	Infrastructure in UX15	313 days	17 Mar '03	26 May '04
	UX available for ATLAS	0 days	10 Oct '03	10 Oct '03
	ATLAS Bedplates & Feet	25 days	10 Oct '03	14 Nov '03
	PHASE 2: Barrel Toroid & Barrel Calorir	**279 days**	**17 Nov '03**	**9 Dec '04**
	Phase 2a: Barrel Toroid	***279 days***	**17 Nov '03**	**9 Dec '04**
	TB Coils 1-2	60 days	17 Nov '03	6 Feb '04
	Rail Supports and Rails	8 days	26 Jan '04	4 Feb '04
	TB Coils 3 & 4	38 days	9 Feb '04	31 Mar '04
	TB Coils 5-8	76 days	1 Apr '04	15 Jul '04
	HS upper part	20 days	16 Jul '04	12 Aug '04
	Fix Rails	14 days	13 Aug '04	1 Sep '04
	Shielding nose mono-block side A	5 days	13 Aug '04	19 Aug '04
	TB Proximity Services	136 days	1 Apr '04	7 Oct '04
	TB Functional test	45 days	7 Oct '04	9 Dec '04
	Phase 2b: Barrel Calorimeter	***96 days***	**15 May '04**	**27 Sep '04**
	Barrel Calorimeter Assembly	71 days	15 May '04	23 Aug '04
	Chimney	14 days	2 Sep '04	21 Sep '04
	Shielding nose mono-block side C	5 days	21 Sep '04	27 Sep '04





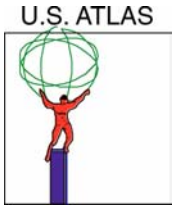
Definitions

- U.S. ATLAS Research Program is needed to support the ATLAS Experiment and especially our deliverables. It includes:
  - Maintenance and Operations (M&O) which includes:
    - Pre-operations: all activities until operations
    - Operations: Beams-on time ~8 months/year
    - Maintenance: Ongoing plus Beams-off time every 1-2 years of ~4 months
  - Upgrade R&D
    - Upgrade R&D is envisaged for the luminosity upgrade of the LHC 10^{35} cm^{-1} s^{-1}
      - New more radiation hardened electronics: Pixels, Silicon Strips, LAr Front End Boards (FEB), LAr ROD upgrade, etc.
  - Physics and Computing (not reviewed here)



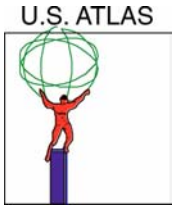
M&O at CERN

- CERN asked each experiment to estimate M&O
  - ATLAS had a Working Group and produced a document which divided costs into different categories:
    - Category A – Common Funds Shared by the whole experiment or System
    - Category B – Shared by a detector system e.g. Liquid Argon Calorimeter
    - Category C – Host Lab responsibility (minimized by CERN – even excluding electric power)
- In August/September a small group representing the RRB (Resource Review Board – funding agencies) started to "scrutinize" the M&O estimates and found and separated some costs which were called "C&I" Commissioning and Integration. The scrutinizing continued for M&O Category A, B and C, and C&I. Category A&B



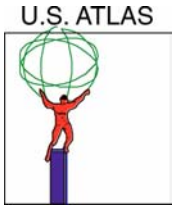
CERN MOU on M&O

- There is a DRAFT MOU for M&O which is being finalized for THIS year. Kirk and Willis will be expected to sign!
- ATLAS is working on determining all the manpower needed for M&O. However, this is not usually accounted for in the European tradition.
- Under a reorganized Technical Coordination, ATLAS has an installation schedule which all systems are trying to follow
- The U.S. M&O program will focus on the U.S. deliverables – we plan to support our deliverables through the C&I and M&O stages.
- For ATLAS there will be requests for contributions in 2002 to "Supplementary Costs" (52 MCHF)- overruns and for M&O (22.4 MCHF 2002-2005) and C&I (Commissioning and Integration) (21.1 MCHF). Our position is the following:
  - On the cost overruns - we are capped at $163.75 and are trying to maximize our deliverables by adding any items that we can from the Management Contingency list. We estimate that we could have 12-15 MCHF available yet for ATLAS. This will be assigned to obtain the greatest benefit for the experiment for detector elements, integration, common projects and other costs. We have set up a mechanism, the U.S. Management Contingency Steering Group, to determine how to use these funds for the best in ATLAS. Costs.
  - On the M&O and C&I Category A&B- we plan to contribute our share - We expect to support Category A&B M&O funds. For C&I, we expect in FY2002-FY2004 to have limited funds. We will contribute to C&I by our support of the pre-operations for the U.S. deliverables.



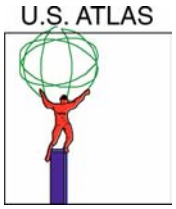
Our Share of the ATLAS M&O

- Our share of the Category A expenses (based on number of "authors") is ~16%
- Our share of M&O expenses for the Category B expenses based on our contribution to the subsystem:
  - Silicon – 14%
  - TRT – 7%
  - Liquid Argon 21.8%
  - Tile Calorimeter 21.4%
  - Muon Spectrometer 20.3%
  - Trigger/DAQ – included in Category A
- In each case we assumed invoices received in, for example, calendar Year 2002 would be paid in the first quarter of fiscal year 2003. We also assume 1.4 CHF=$1 which is an average over many years.



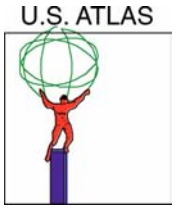
U.S. ATLAS Estimates for M&O

- **Bottom-up estimate**
  - Time phased and activity driven WBS
    - Pre-operations
    - Operations
    - Maintenance
    - Common Costs
  - Labor split into some standard skill types
  - Institutional rates and overheads applied
  - Attempt to make uniform standards for travel costs and relocation expenses
  - All data captured in an Access database
    - Data entered by fiscal year – a more detailed task driven schedule information seems premature
- **Management Reserve / Contingency = 25% seems reasonable on average for this level of estimate**



U.S. ATLAS Research Program BOOKs

- Estimates were developed using Fixed FY 02 Dollars.
- Subsystem WBS structure mirrors the Construction Project.
- Reports have a *"Funding Type: Program"* heading reference for cost or labor FTEs associated with the Research Program.
- Labor FTEs estimates for Non-Research Program funding are included, see FTEs reports that have a "*Funding Type: Base & Infrastructure*"



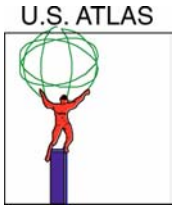
U.S. ATLAS M&O Backup Materials

- **Subsystem Cost Profiles Reports**
  - WBS Level 3 for: All Costs, *Labor Cost Only* and *Material Cost Only.*
  - WBS Level 5 for All Costs
- **Subsystem Staffing Profile (FTEs) Reports**
  - WBS Level 2 Summary (Program / Base & Infrastructure / All)
  - WBS Level 3 Summary (Program / Base & Infrastructure / All)
- **Subsystem WBS Dictionary**
  - WBS Level 5, includes dictionary and basis of estimate comments.

U.S. ATLAS Upgrade R&D Backup Materials

Silicon and Liquid Argon

- **Subsystem Cost Profiles Reports**
  - WBS Level 4 for: All Costs, *Labor Cost Only* and *Material Cost Only.*
- **Subsystem Staffing Profile (FTEs) Reports**
  - WBS Level 2 Summary -Program
  - WBS Level 3 Summary -Program
- **Subsystem WBS Dictionary**
  - WBS Level 5, includes dictionary and basis of estimate comments.



U.S. ATLAS Research Program
Other Reference Material

- Escalation Table
- ATLAS M&O Cost Estimates 2002-2007
- ATLAS C&I Cost Estimates 2002-2005
- Draft U.S. ATLAS Research Operations Management Plan

Labor Estimates - Program

MANPOWER ESTIMATE SUMMARY IN FTEs

WBSNo: 3

Description: U.S. ATLAS M&O Estimate

Funding Type: Program → Research Program OR Base/Infrastructure

Institutions: All

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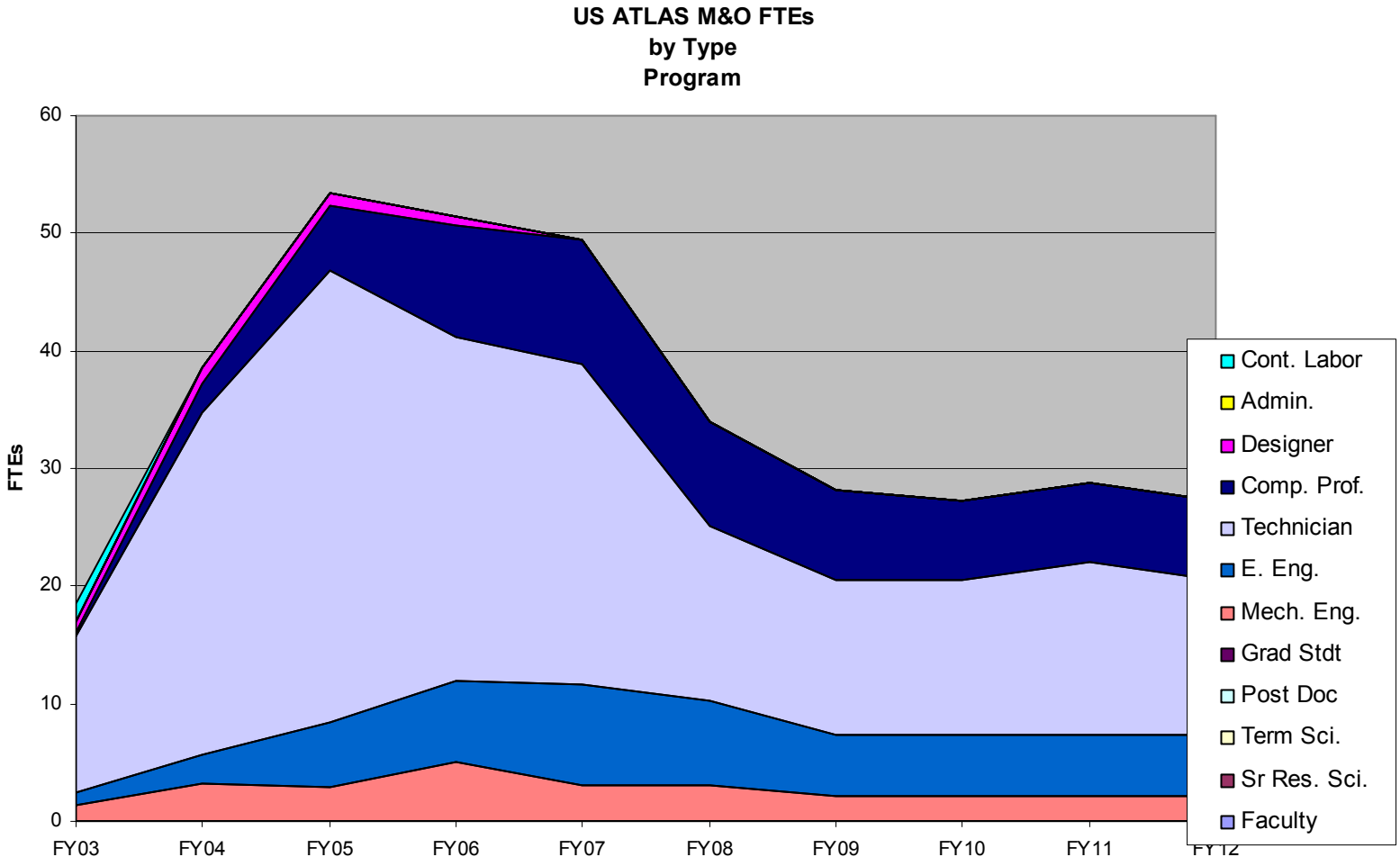
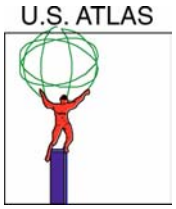
Funding Source : All → DOE & NSF

Or "ALL" = SUM

	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	Calculated Total	Entered Total
Faculty											.0	.5
Sr Research Scientist											.0	.0
Term Scientist											.0	.0
Post Doc									.0		.0	.0
Grad Student											.0	.0
Mechanical Engineer	1.4	3.1	2.9	5.1	3.0	3.0	2.1	2.1	2.1	2.1	26.8	.0
Electrical Engineer	1.1	2.5	5.4	6.9	8.5	7.1	5.4	5.4	5.4	5.4	53.0	.0
Technicial	13.3	29.2	38.3	29.1	27.2	14.8	13.2	13.2	14.7	13.2	206.1	.0
Computer Profession	.2	2.4	5.4	9.3	10.5	8.9	7.7	6.7	6.7	6.7	64.5	.0
Designer	1.0	1.4	1.1	.7	.0	.0	.0	.0	.0	.0	4.1	.0
Adminsitrator											.0	.0
Contract Labor	1.5			.0					.0		1.5	.0
TOTAL LABOR	18.4	38.6	53.2	51.0	49.1	33.8	28.3	27.3	28.8	27.3	355.9	.5

M&O Labor: Supported by the "Program"





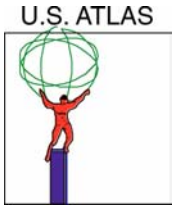
Labor Profile: Base/Infrastructure

MANPOWER ESTIMATE SUMMARY IN FTEs

WBSNo: 3 | Funding Type: Base+Infrastructure | 4/4/02 3:01:16 PM

Description: U.S. ATLAS M&O Estimate | Institutions: All | Funding Source : All

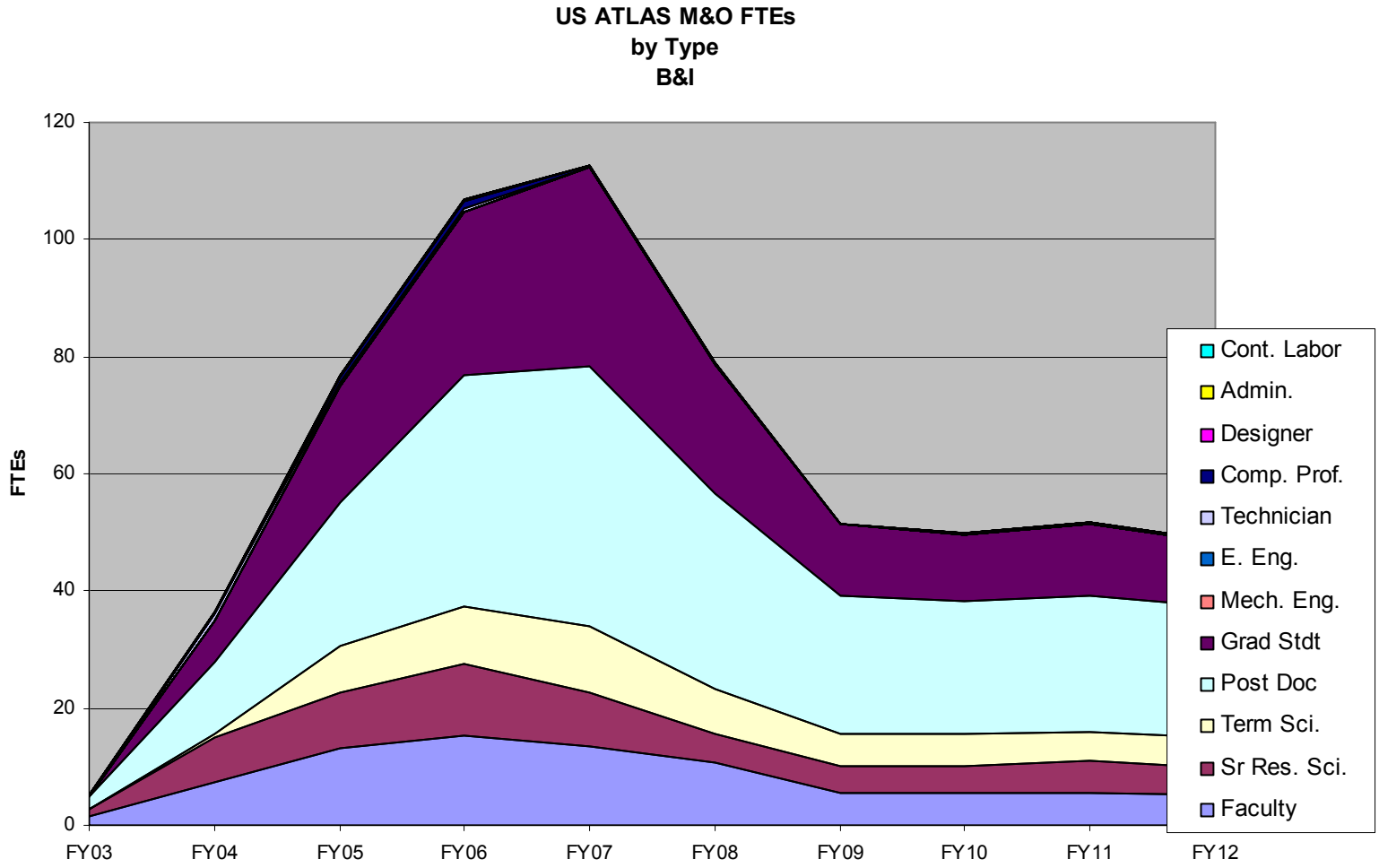
	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	Calculated Total	Entered Total
Faculty	1.5	7.1	13.0	15.3	13.3	10.8	5.6	5.5	5.4	5.3	82.7	.0
Sr Research Scientist	1.4	7.9	9.5	12.1	9.3	4.7	4.6	4.6	5.6	4.6	64.2	.0
Term Scientist	.1	.6	7.9	9.7	11.1	7.6	5.5	5.5	5.0	5.0	57.7	.0
Post Doc	1.9	12.3	24.4	39.4	44.6	33.4	23.5	22.8	23.3	22.3	247.9	.0
Grad Student		7.0	20.0	28.0	34.0	22.1	12.1	11.2	12.2	11.2	157.9	.0
Mechanical Engineer											.0	.0
Electrical Engineer											.0	.0
Technicial		1.1	.5	.5							2.1	.0
Computer Profession			1.0	1.3	.3	.3	.2	.2	.2	.2	3.8	.0
Designer	.3	.3	.3	.3							1.0	.0
Adminsitrator											.0	.0
Contract Labor											.0	.0
TOTAL LABOR	5.2	36.2	76.6	106.5	112.5	78.9	51.5	49.7	51.6	48.5	617.2	.0



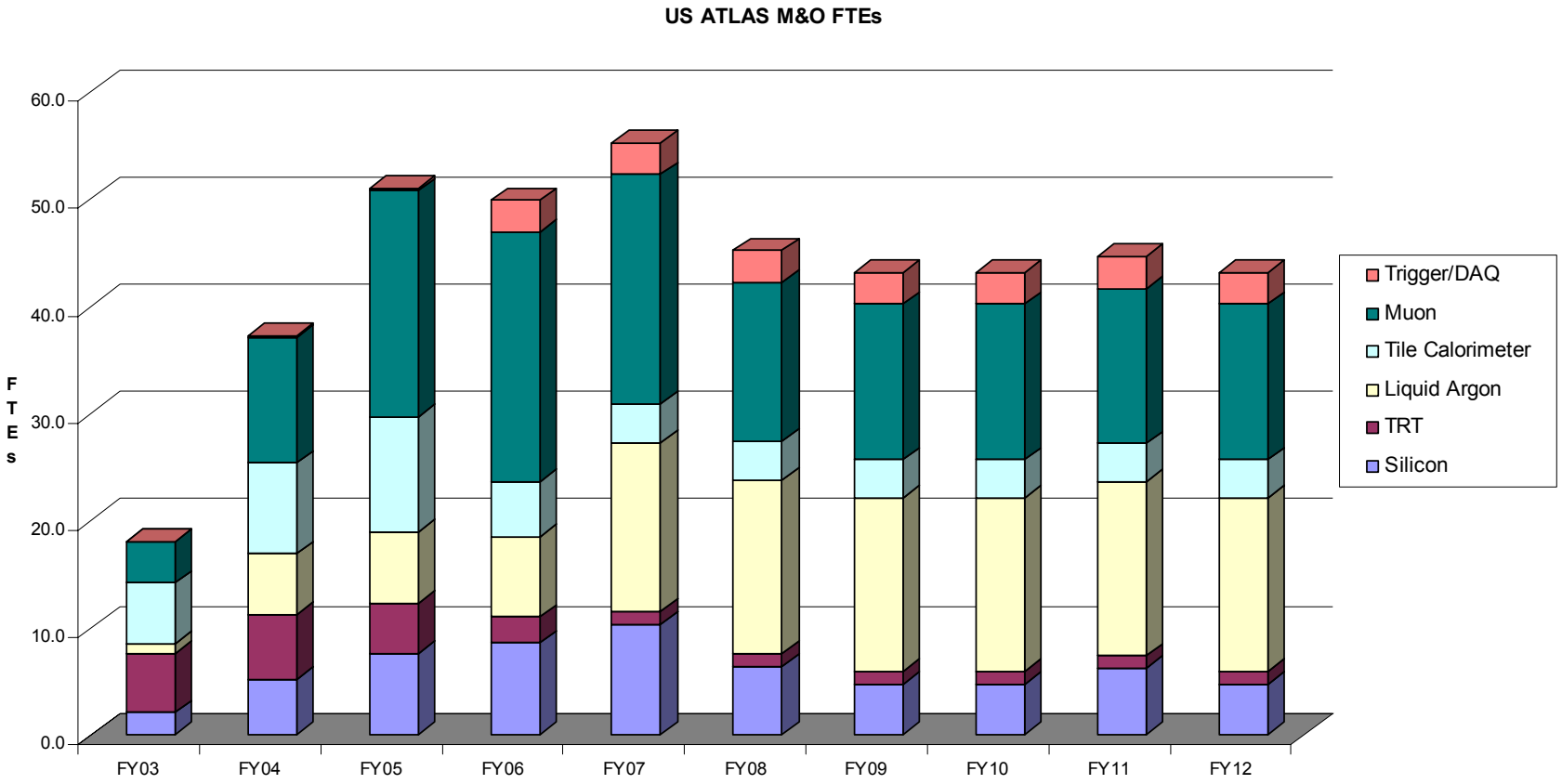
Comparison with Other Experiments

- BaBar has ~150 FTE's doing M&O (in addition to shifts, physics analysis, and computing work) Almost all of these are physicists.
- D0 has an M&O staff of:
  - 15 mechanical
    - 2 Engineers
    - 13 Technicians
  - 19 electrical
    - 11 Engineers
    - 8 Technicians
  - Total 33
- Different experiments account things differently
- ATLAS is a factor (3-5) more complex than these experiments.
  - After FY08 we need 28 FTEs * 6 (Our Share) = 168/5 = 34

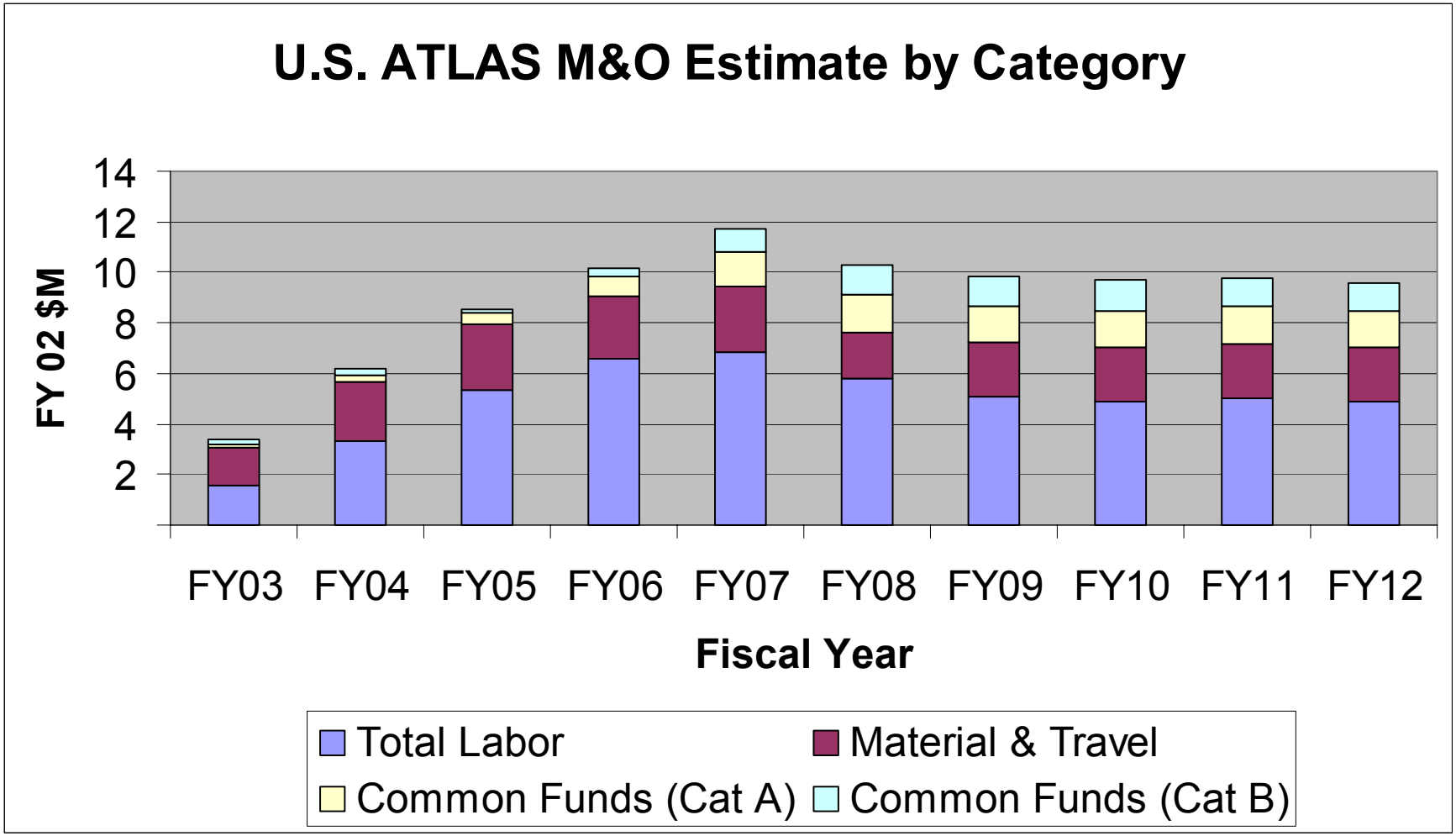
Labor Profile: Base/Infrastructure

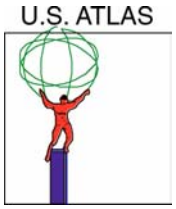


U.S. ATLAS M&O FTEs
Program Supported



U.S. ATLAS M&O Breakout





Total Profile; Labor; Material

U.S. ATLAS M&O Estimate
WBS Profile Estimates

Funding Source: All
Institutions All
Funding Type: Program
Labor/Material: Both
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WBS Number	Description	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	FY 12 (k$)
3.0	U.S. ATLAS M&O Estimate	3407	6181	8541	10182	11725	10295	9825	9694	9740	9559
	U.S. ATLAS M&O Labor	1540	3351	5341	6574	6863	5808	5101	4913	5045	4913
	U.S. ATLAS M&O Material	1867	2830	3200	3608	4862	4487	4724	4781	4695	4646

Breakout by Subsystem

U.S. ATLAS M&O Estimate

WBS Level 2 Profile Estimates

Funding Source: All
Institutions All

Funding Type: Program
Labor/Material: Both

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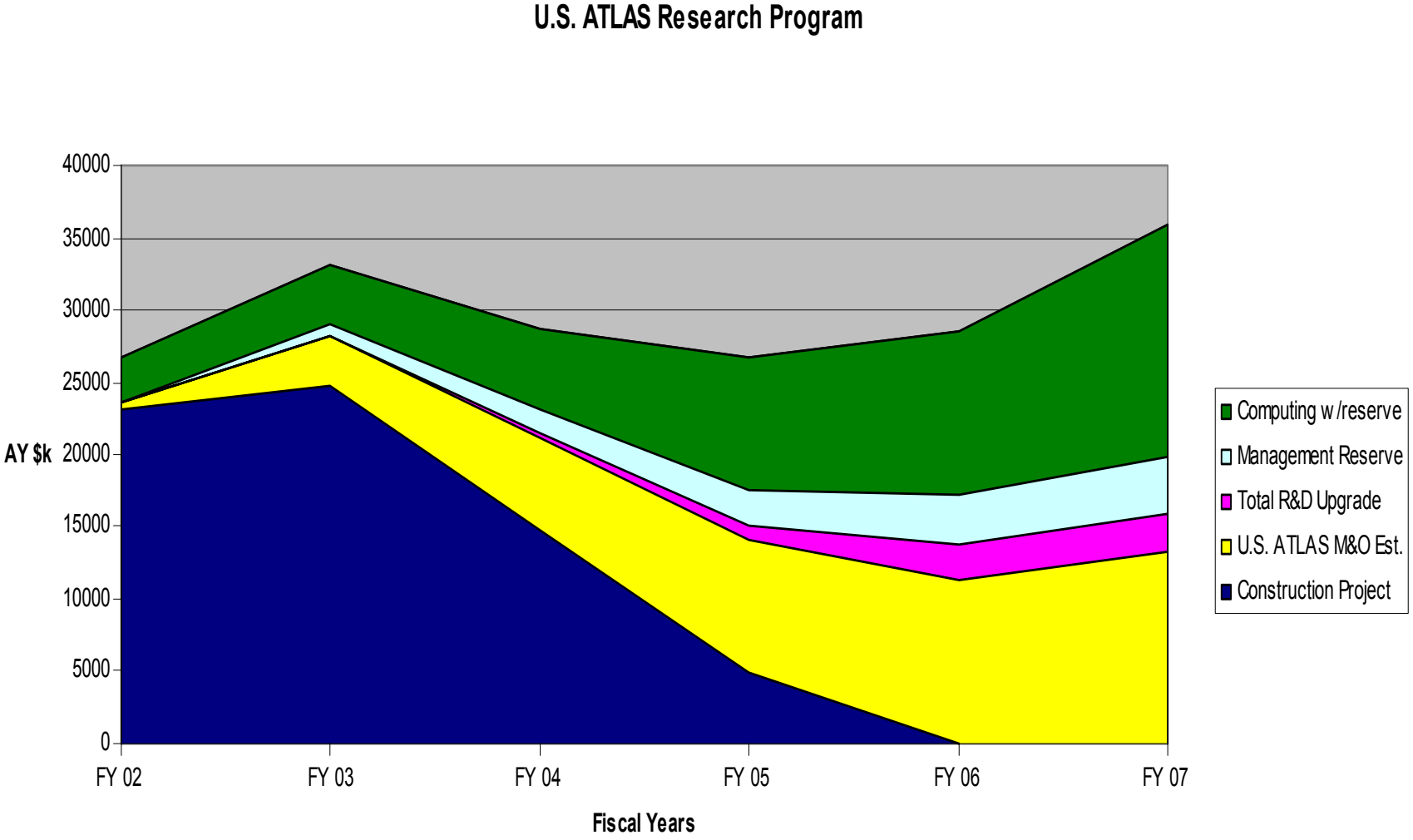
Fixed FY 02 $k

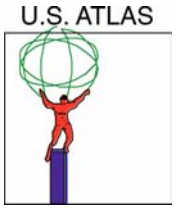
WBS Number	Description	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	FY 12 (k$)
3.0	U.S. ATLAS M&O Estimate	3407	6181	8541	10182	11725	10295	9825	9694	9740	9559
3.1	Silicon	377	329	542	1509	1582	1346	1055	1094	1201	1004
3.2	TRT	534	1267	695	402	319	374	382	401	340	356
3.3	Liquid Argon M&O Estimate	208	673	1417	1825	3122	3059	3068	2880	2880	2880
3.4	Tile Calorimeter System	924	875	1158	807	772	782	780	779	779	779
3.5	Endcap Muon	809	1823	2495	2124	1657	610	595	595	595	595
3.6	Trigger/DAQ	18	129	61	785	978	704	525	525	525	525
3.7	Common Funds	132	274	447	766	1331	1457	1457	1457	1457	1457
3.8	Education	103	159	191	225	225	225	225	225	225	225
3.9	Project Management	302	302	934	938	938	938	938	938	938	938
3.10	Technical Coordination	0	350	600	800	800	800	800	800	800	800

M&O and Upgrade R&D + Computing

WBS	Description	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07
		AY $k					
3.0	**U. S. ATLAS M&O**	**486**	**3479**	**6469**	**9197**	**11271**	**13316**
3.1	Silicon	194	385	344	584	1671	1797
3.2	TRT		545	1326	748	445	362
3.3	Liquid Argon		212	704	1526	2020	3546
3.4	TileCal	204	943	916	1247	893	877
3.5	Muon	0	826	1908	2687	2351	1882
3.6	Trigger/DAQ		18	135	66	869	1111
3.7	Common ATLAS	88	135	287	481	848	1512
3.8	Education / Outreach		105	166	206	249	256
3.9	Project Office		308	316	1006	1038	1065
3.10	Technical Coordination		0	366	646	886	909
4.0	**U. S. ATLAS R&D Upgrade**	**0**	**0**	**249**	**925**	**2505**	**2510**
4.1	Silicon		0	249	925	1885	1913
4.2	TRT		0	0	0	0	0
4.3	Liquid Argon		0	0	0	620	597
4.4	TileCal		0	0	0	0	0
4.5	Muon		0	0	0	0	0
	Reserve @ 25% of M&O and R&D	**0**	**870**	**1679**	**2530**	**3444**	**3957**
2.0	**Computing w/reserve**	**3090**	**3982**	**5667**	**9157**	**11281**	**16049**
	Grand Total (RP Need)	**3576**	**8330**	**14065**	**21809**	**28501**	**35832**
	Construction Project	**23157**	**24706**	**14690**	**4909**		
	DOE RP Guidance @3/02	2550	3350	4400	13000	22500	23500
	NSF RP Guidance @ 60% of DOE	1530	2010	2640	7800	13500	14100
	Total Target Funding	**4080**	**5360**	**7040**	**20800**	**36000**	**37600**
	Need vs. Target	504	(2970)	(7025)	(1009)	7499	1768

Total U.S. ATLAS Program





Conclusions

- We have a successful Construction Project with U.S. Deliverables now arriving at CERN
  - Investment: $163.75M
- We need to support our deliverables through the U.S. ATLAS Research Program
- We have a reasonable estimate of our needs for the Research Program
- As you will hear tomorrow in detail, it needs to be fully funded starting in FY03